8. GROUNDWATER MONITORING

This section of the ISB RAWP identifies the requirements, and the basis for the requirements, for ISB groundwater monitoring. The groundwater monitoring requirements are derived from the RAOs and performance goals defined in the ROD Amendment (DOE-ID 2001a) through the data quality objectives (DQO) process. The output of the DQO process is a groundwater monitoring strategy designed to assess progress toward, and completion of, the RAOs and performance goals. Section 2 of this RAWP defines the performance and compliance objectives necessary to show achievement of the RAOs.

Data collected through groundwater monitoring will be used specifically to assess performance of the remedy, determine the need for operational changes, and support agency performance and compliance reviews. This section of the RAWP covers the following:

- Data quality objectives
- Monitoring strategy
- Data collection
- Sample management and analysis
- Data management and reporting.

A GWMP (INEEL 2002d) has been prepared to implement the requirements of this section.

In addition to providing data for evaluation of ISB performance and compliance objectives, the ISB groundwater monitoring program shall also provide data for the evaluation of two other remedial action monitoring requirements, which govern the monitoring of radionuclides. The first requirement is the RAO requirement that all COCs (radionuclides included) be below MCLs by 2095.This is a requirement and objective of MNA. The second monitoring requirement is to provide data to evaluate the migration of radionuclides from the source area into the medial zone. This data will be used to satisfy the NPTF performance/compliance monitoring (PM/CM) requirement for medial zone source control.

8.1 Data Quality Objectives

Data quality objectives for the ISB component of the remedy are based on (1) decision types requiring groundwater monitoring data, (2) EPA DQO guidance (EPA 1994), (3) method detection limits, and (4) experience with the sampling and analysis methods to date. Requirements for data quality for all INEEL CERCLA investigations and remedial responses are defined in the *Quality Assurance Project Plan (QAPjP) for Waste Area Groups 1, 2, 3, 4, 5, 6, 7 and 10* (DOE-ID 2000b). Appendix D contains the ISB DQO development process.

Decisions requiring groundwater-monitoring data are based on the RAOs and performance objectives for the ISB component of the remedy. These decisions are as follows:

1. Determine whether operational changes are required by routinely monitoring the performance of the ISB system with respect to indicator parameters, including VOCs, tritium, ethene/ethane/methane, redox parameters, electron donor, bioactivity, and nutrients.

2. Determine whether downgradient flux of contaminants from the hotspot has been cut off, as evidenced by VOC concentrations below MCLs at TAN-28 and -30A.

3. Determine whether crossgradient flux of contaminants from the hotspot has been cut off, as evidenced by VOC concentrations below MCLs at monitoring wells PMW-1 and PMW-2.

4. Determine whether long-term operations are complete (the compliance criteria for long-term operations will be specified in the ISB Remedial Action Report).

The result of the DQO development to support these decisions is the monitoring strategy described below. A detailed discussion of DQO development along with a discussion of specific indicator parameters (compliance and performance) is provided in Appendix D.

8.2 Monitoring Strategy

The monitoring strategy incorporates the results of the DQO process described in Appendix D, as well as experience gained in 4 years of ISB field evaluation and predesign operations. The ISB remedial action implementation strategy shown in Figure 2-1 is divided into four operational phases, (1) interim operations, (2) initial operations, (3) optimization, and (4) long-term operations. With the exception of interim operations, two monitoring components (i.e., performance and compliance) are defined for each operational phase.

The performance and compliance monitoring strategies created to support the implementation strategy are summarized in Tables 8-1 and 8-2, respectively, and are described below. Monitoring locations, analytes, sampling frequencies, and data quality requirements for each phase of operations and monitoring are defined and detailed in the ISB GWMP (INEEL 2002d). Definition of data quality requirements includes analytical methods, action levels, and detection limits for all analytes and phases of monitoring.

The overall OU 1-07B ISB remedial action sampling strategy to support the decisions listed in Section 8.1 is as follows:

- **Interim operations performance monitoring** (Decision 1): Includes monthly sampling for performance indicator parameters at all 15 existing ISB locations for the duration of the phase.

- **Initial operations performance monitoring** (Decision 1): Includes monthly sampling for performance indicator parameters at all 15 ISB locations, including new monitoring wells PMW-1 and PMW-2, for the duration of the phase. This strategy includes monitoring for VOCs at TAN-28 and TAN-30A to determine downgradient contaminant flux trends.

- **Initial operations compliance monitoring** (Decision 2): The strategy for determining when downgradient flux of VOCs from the hot spot is cut off includes quarterly monitoring for 1 year at TAN-28 and TAN-30A for VOCs. This sampling will begin when performance monitoring indicates that VOC concentrations are below MCLs at TAN-28 and TAN-30A.

- **Optimization operations performance monitoring** (Decision 1): Includes monthly sampling for performance indicator parameters at all 15 ISB locations, including new monitoring wells PMW-1 and PMW-2, for the duration of the phase. The monthly sampling frequency will be continued to identify trends requiring operational modifications. This strategy includes monitoring for VOCs at monitoring wells PMW-1 and PMW-2 to determine crossgradient contaminant flux trends.

- **Optimization operations compliance monitoring** (Decision 3): The strategy for determining when crossgradient flux of VOCs from the hotspot is cut off is quarterly monitoring for 1 year at monitoring wells PMW-1 and PMW-2 for VOCs. This sampling will begin when compliance monitoring indicates that VOC concentrations are below MCLs at PMW-1 and PMW-2.

Table 8-1. In situ bioremediation remedial action groundwater performance monitoring strategy summary.

Monitoring Type/ Strategy Element	Operational Phase			
	Interim	Initial	Optimization	Long-term
Decision Number	1			
Monitoring Duration	Duration of Phase			
Monitoring Frequency	Monthly[a]			Quarterly[a]
Monitoring Locations	TSF-05A, TSF-05B, TAN-10A, TAN-25, TAN-26, TAN-27, TAN-28, TAN-29, TAN-30A, TAN-31, TAN-37A, TAN-37B, TAN-37C, and TAN-D2.	TSF-05A, TSF-05B, TAN-10A, TAN-25, TAN-26, TAN-27, TAN-28, TAN-29, TAN-30A, TAN-31, TAN-37A, TAN-37B, TAN-37C, and TAN-D2, PMW-1, PMW-2		
Analytes	VOCs (PCE, TCE, cis- and trans-DCE, vinyl chloride), electron donors (COD, lactate, acetate, propionate, butyrate), redox parameters (ferrous iron, sulfate), bioactivity parameters (alkalinity), dissolved gases (ethene, ethane, methane), and radionuclides (Cs-137 and Sr-90 (NPTF/MNA source area PM parameters identified in Table 2-2) and tritium).			
Data Quality Required[b]	Screening w/definitive confirmation for VOCs Screening for all other analytes			
Data Validation Level Required[c]	Level A for chloroethene definitive confirmation and radionuclide analyses No data validation for on-site and IRC laboratory data			

a: Includes semiannual nutrient analyses and annual definitive confirmation for VOCs

b: Data quality levels are defined in the QAPjP.

c: Data validation levels are defined in the QAPjP.

Table 8-2. In situ bioremediation remedial action groundwater compliance monitoring strategy summary.

Monitoring Type/ Strategy Element	Operational Phase			
	Interim	Initial	Optimization	Long-Term[a]
Decision	N/A	2	3	4
Monitoring Duration	N/A	1 year		TBD
Monitoring Frequency	N/A	Quarterly		TBD
Monitoring Locations	N/A	TAN-28 TAN-30A	PMW-1 PMW-2	TBD
Analytes	N/A	VOCs (PCE, TCE, cis- and trans-DCE, vinyl chloride)		TBD
Data Quality Required[b]	N/A	Definitive		TBD
Data Validation Level Required[c]	N/A	Level A		TBD

a. The long-term compliance monitoring strategy will be submitted in the ISB Remedial Action Report.

b: Data quality levels are defined in the QAPjP.

c: Data validation levels are defined in the QAPjP.

N/A: Not applicable

TBD: To be determined

- **Long-term operations performance monitoring** (Decision 1): Includes quarterly sampling for performance indicator parameters at all 15 ISB locations, including the new monitoring wells PMW-1 and PMW-2, for the duration of the phase. The ISB system will be functional and operational during this phase (with a defined operating strategy) and, therefore, will result in reduced performance sampling requirements. The number of monitoring locations and analytes may also be reduced during this phase.

- **Long-term operations compliance monitoring** (Decision 4): The sampling strategy for determining when the remedy is complete will be defined in the remedial action report.

8.3 Sampling Equipment and Procedures

The sampling equipment and procedures required to support the monitoring strategy are detailed in the ISB GWMP (INEEL 2002d). Sampling procedures identify the equipment and techniques necessary to implement required sampling. These procedures, which address training, equipment, instrument calibrations, purging, sampling, purge water management, decontamination and cleaning of equipment, and record keeping in support of the monitoring plan, will be updated as required for the duration of monitoring. Multiparameter water quality sensors may be used for collecting purge parameter data during sampling, and for in situ deployment in wells for the duration of the remedy implementation. Multilevel sampling may be performed and FLUTe liners may be installed in monitoring wells TAN-37, PMW-1, and PMW-2 as part of remedy implementation. All waste materials (e.g., PPE, bottles, rinsates, and purge waters) generated as a result of sampling activities will be managed in accordance with the *Waste Management Plan for TAN Final Groundwater Remediation OU 1-07B* (INEEL 2001a).

Operable Unit 1-07B ISB well information is maintained in the OU 1-07B project files and in the INEEL Hydrologic Data Repository . Information includes well names and aliases, locations, construction diagrams, material types, depths, screened or open intervals, discharge hose or pipe dimensions, sampling depths, maintenance history, and other information. Well maintenance and water level measurement activities, both of which contribute to the OU 1-07B Groundwater Monitoring Program, will be performed as described in the ISB O&M Plan (DOE-ID 2002b).

8.4 Sample Management and Analysis

The three analytical components comprising the ISB groundwater monitoring program are (1) onsite analyses and measurements, (2) sample analysis performed at the INEEL Research Center (IRC), and (3) sample analysis performed at offsite laboratories. This section identifies the requirements of the sample management and analysis strategies. Figure 7-1 is a flow chart that describes the interface between groundwater monitoring and O&M. This figure shows the relationship between the collection and analysis of samples and data interpretation.

8.4.1 Sample Management

A sample management plan shall be instituted as part of the groundwater-monitoring program that manages, tracks, and stores data collected. This plan shall have an orderly sample identification, designation, and tracking system that tracks samples from collection through shipping, analysis, and interpretation and into long-term data storage. A sample management procedure shall be developed that provides clear direction regarding sample management throughout the life of the project.

8.4.2 Sample Analysis

Sample analysis will be conducted using three analytical components (i.e., the on-site field laboratory, the IRC laboratory, and the sample management office-appointed off-Site laboratories) dependent upon holding time restrictions, analytical capabilities, and quality level requirements. Analytes and analytical methods to be used for each of the three components shall be defined in the ISB GWMP (INEEL 2002d) and ancillary procedures. Equipment and procedures consistent with the analytical method requirements will be employed for each analytical component. Quality assurance requirements specific for each of the three components are described in the ISB GWMP.

8.4.2.1 On-site Field Laboratory Activities. The field laboratory supports all ISB project team activities for all three analytical components of the monitoring program. The field laboratory is the center for all on-Site data collection activities, including field test kits, in situ hydrolab data, and purge data. These activities provide near real-time data for evaluation of the performance of the ISB remedy. In addition, the field laboratory is used to coordinate sample delivery to the IRC and sample shipment to off-Site laboratories. Specific activities that the field laboratory supports include field test kit analyses; gross alpha-beta counts; sample packing and shipping; hydrolab deployment, maintenance, calibration, and downloading; sample bottle preparation; and administrative activities.

8.4.2.2 Idaho National Engineering and Environmental Laboratory Research Center Laboratory Activities. Analysts at the IRC laboratories determine VOCs, ethene/ethane/methane, and volatile organic acids using the methods described in the ISB GWMP and ancillary procedures. The ISB GWMP identifies all other analytical methods as well as procedures and protocols for implementing the monitoring strategy.

8.4.2.3 Off-Site Laboratory Activities. Off-Site laboratories determine contaminant concentrations using methods appropriate for definitive data. The methods used by off-Site laboratories are specified in the ISB GWMP (INEEL 2002d).

8.5 Data Management

The O&M section of this RAWP outlines the requirements and the ISB O&M Plan (DOE-ID 2002b) describes in more detail the data management plan for this project. This will be the process used by the project to enter, manipulate, evaluate, and archive data generated during implementation of the ISB remedy. Figure 7-1 is a flow chart that describes the interface between groundwater monitoring and O&M. This figure shows the relationship between the collection and analysis of samples and data interpretation.

9. DEACTIVATION, DECONTAMINATION, AND DECOMMISSIONING

Decontamination is a process whereby contaminants that have accumulated on or in equipment, tools, or treatment systems are removed or neutralized such that they no longer present a hazard to human health or the environment. Decontamination efforts associated with OU 1-07B have been grouped into two activities. These two activities include (1) those that are involved with day-to-day operations and investigations (i.e., interim decontamination) and (2) those that are associated with the final shut down and decommissioning of any treatment facilities used to remediate the OU (i.e., final decontamination).

9.1 Interim Decontamination

Detailed procedures for decontamination can be found in the *Interim Decontamination Plan for OU 1-07B* (INEEL 2001b).

Decontamination of the tanks, containers, and equipment used for the remedial actions associated with OU 1-07B involves removal and disposal of waste present in the containers and decontamination of the interiors of tanks, containers, and associated ancillary equipment in contact with waste, as necessary. Decontamination consists of rinsing the item to be decontaminated with water to meet the performance criteria in the interim decontamination plan (INEEL 2001b). Spent decontamination water and other liquid waste streams generated during the decontamination process will be evaluated against OU 1-07B Waste Management Plan (WMP) criteria. Where appropriate, those streams that are compatible will be transferred to the NPTF for processing with the surge tank contents. Those waste streams that are not compatible with NPTF operations will be sampled and analyzed for characterization in accordance with the WMP (INEEL 2001a).

9.2 Final Deactivation, Decontamination, and Decommissioning

Final D&D&D of OU 1-07B treatment systems will be addressed after the Agencies determine that the active remediation is complete or that the treatment systems are no longer required. The D&D&D requirements for each treatment system will be addressed in future D&D&D plans. In general, the D&D&D plans will direct that, for the facilities built to remediate OU 1-07B, all tanks, containers, piping, and equipment be flushed with clean water to remove as much contamination as possible. The system will be dismantled and made ready for decontamination as directed by management. Components that can be decontaminated will be released for use in other systems, or disposed of as industrial waste. The site will be returned to its preoperation condition, to the extent feasible, considering cost and intended future use.

The wells that are placed in the area will continue to be used for monitoring of the aquifer, or will be abandoned in accordance with INEEL procedures. Other equipment and facilities installed during the remediation activities will be dismantled, decontaminated, and disposed of in accordance with INEEL policy and procedures.

The OU 1-07B CERCLA Waste Storage Unit adjoining the hot spot site will be left as-is for storag,e as needed. The waste stored within will be processed and disposed of as addressed in the WMP (INEEL 2001a). These CERCLA Waste Storage Unit s may be moved to other locations, if the need arises.

10. WASTE MANAGEMENT

All waste generated during ISB will be managed in accordance with the provisions of the WMP (INEEL 2001a). Equipment and material decontamination requirements and procedures are specified in the Interim Decontamination Plan (INEEL 2001b). All of the materials to be used in the nutrient addition system are nonhazardous. Any waste generated from operations of the nutrient addition system will be managed and disposed of as nonhazardous solid waste.

All waste generated during the OU 1-07B remedial action will be managed and disposed of in accordance with applicable waste management requirements, including those contained in the *Waste Certification Plan for the Environmental Restoration Program* (INEEL 1996b) and the *INEEL Reusable Property, Recyclable Materials, and Waste Acceptance Criteria* (DOE-ID 1997). All waste management activities will be conducted in accordance with the applicable substantive requirements of the Resource Conservation and Recovery Act (RCRA).

Specific waste management regulatory issues that are applicable to OU 1-07B are summarized in the following sections. These include:

- Resource Conservation and Recovery Act -listed waste
- Toxic Substance and Control Act -regulated waste
- Low-level radioactive waste.

10.1 Resource Conservation and Recovery Act Listed Waste

10.1.1 Listed Waste Determination

The TSF-05 injection well was drilled in 1953 to a depth of 93 m (310 ft) to dispose of liquid effluent generated from the Aircraft Nuclear Propulsion project. Discharges to the well included organic sludge, treated sanitary sewage, process wastewater, and low-level radioactive waste streams. The principal VOC discharged was TCE. Estimates of the volume of TCE discharged to the well range from 1,325 to 97,161 L (350 to 25,670 gal). Previous evaluations of the solvents used at TAN concluded that the waste discharged to the injection well was not an RCRA-listed hazardous waste because the organic chemicals in the waste were not used as solvents, or for degreasing, and because the actual usage practices were not known (DOE-ID 1995).

In April 1997, based on new information, it was determined that an RCRA-listed solvent (TCE) was disposed of at the TAN Facility by the TSF-21 valve pit. Since the valve pit is connected with the TSF-05 injection well, the injection well and associated groundwater contamination plume are considered to contain RCRA-listed waste. The RCRA-listed waste classification, waste code F001 is, therefore, applicable to the TCE-contaminated TAN groundwater and associated waste streams. The substantive requirements of the ARARs are applicable for the RCRA-listed waste (INEEL 1997a). The listed waste determination was implemented for OU 1-07B for waste that was not previously determined to be characteristic based on the OU 1-07B Waste Management Compliance Commitments and Schedule dated July 22, 1997. The Agencies were notified by a DOE letter.[a]

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a. Letter from K.E. Hain (DOE-ID), Manager of Environmental Restoration Program, to K. L. Falconer (INEEL), Director of Environmental Restoration, DOE-ID Letter OPE-ER-129-97, August 29, 1997.

10.1.2 No-Longer Contained-In Determination

Environmental media are considered to potentially contain RCRA-listed hazardous waste if there was a release to the media that included these wastes (40 CFR 261.3). Of the options available to manage waste containing low- to non-detectable concentrations of listed waste, a no-longer contained-in determination (NLCID) may be requested for these environmental media, soil, and groundwater. Until a NLCID is made for the OU 1-07B waste streams, the media will be managed as a listed hazardous CERCLA waste in accordance with the WMP (INEEL 2001a). The NLCIDs that have been approved are attached to the WMP (INEEL 2001a).

10.1.3 In Situ Bioremedation Sampling Purge Water

As a result of this listed waste determination, all water extracted from the OU 1-07B groundwater plume must be handled in such a way as to meet the substantive requirements of the ARARs for RCRA-listed waste. As part of the ISB remedial component, routine groundwater sampling occurs producing significant quantities of purge water. This purge water shall be collected throughout sampling activities and processed through the NPTF. The NPTF air and water effluent discharge requirements remain the same for the purge water as with routine NPTF extraction well water.

10.2 Toxic Substances Control Act Regulated Waste

In the 1950s, the V-Tanks were installed to store liquid radioactive waste generated at TAN prior to treatment. Liquid waste was pumped into these tanks from the TSF laboratories and craft shops, hot and warm shops, a radioactive decontamination shop, hot cells, and the Initial Engine Test Facility. In 1968, approximately 227 L (60 gal) of oil was discovered in Tank V-2, reportedly from a spill of hydraulic oil in the hot cell. This oil was subsequently removed in 1981 and sampled. The analysis of the oil revealed polychlorinated biphenyl (PCB) (Aroclor 1260) concentrations up to 680 mg/kg.[b] The PCBs have been identified in all three tanks with maximum concentrations of 660 mg/kg in V-1, 260 mg/kg in V-2, and 400 mg/kg in V-3. The V-tanks have not been used since the early 1980s. Treatment for the liquid radioactive waste, when the V-tank system was in operation, consisted of processing the liquid waste through the evaporator in TAN-616 (and later through the PW-2 well monitoring system) to concentrate the radioactive waste. The wastewater from the evaporator system was discharged to the warm waste system and then to TSF-05.

Recent sampling events at TSF-05 have shown that the PCB concentration in the sludge at the bottom of the well is 6 mg/kg. Since this is less than the 50 mg/kg addressed in 40 CFR 761, the waste generated during the remedial actions at OU 1-07B will be managed as not containing PCBs until such time as sampling shows that the sludge in TSF-05 has PCB concentrations of 50 mg/kg.

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b. Letter from Carlos Tellez (INEEL), Director of Environmental Affairs, to Dan Duncan (EPA), TSCA Program Manager, INEEL Letter CLT-84-97, September 3, 1997.

11. EMERGENCY RESPONSE

Emergency response is covered by the *INEEL Emergency Action (EA)/RCRA Contingency Plan Addendum for TAN Facilities* (INEEL 1997c). The TAN OU 1-07B Health and Safety Plan (HASP) (INEEL 2002e) contains primary emergency response actions for OU 1-07B site personnel, including initial responses, task site responsibilities, emergency equipment at the task site, emergency response teams, and notification lists. This section of the HASP supplements the INEEL EA/RCRA Contingency Plan. Copies of both documents are kept in the OU 1-07B office located in Building TAN 607. A copy of the HASP will also be kept in the hazardous communications center located at the OU 1-07B remediation site.

The INEEL EA/RCRA Contingency Plan (INEEL 1997c) includes emergency response organizations and operational emergency event classes for the following events:

- Fires
- Explosions
- Radiological releases
- Nonradiological releases
- Natural phenomena
- Loss of power
- Criticalities
- Safeguards and security
- External events.

Sections 5 through 14 of the contingency plan address notifications and communications, consequence assessment, protective actions, medical support, recovery and reentry, public information, emergency facilities, training (in the OU 1-07B HASP), drills and exercises, and program administration. The INEEL EA/RCRA Contingency Plan contains OU 1-07B Appendix L4, which is specific to the OU 1-07B project and defines specific measures and criteria used for OU 1-07B activities.

Emergency actions are primarily governed by the HASP; however, the INEEL EA/RCRA Contingency Plan will be implemented when emergencies result that are beyond the limitations of the HASP. Therefore, in the event of an emergency, initial responders shall follow the direction of the OU 1-07B HASP unless the resulting emergency is designated as a fire, explosion, or an uncontrolled release to the environment, in which case the INEEL EA/RCRA Contingency Plan will be implemented.

12. QUALITY ASSURANCE PROGRAM

This RAWP is intended to be used in conjunction with the QAPjP (DOE-ID 2000b) and PLN-694, "Environmental Restoration Project Management Plan, for Environmental Restoration and Decontamination and Decommissioning Projects."

The most important activities associated with the ISB hot spot remedial component, with respect to quality assurance, are the data collection and analysis activities for compliance and performance monitoring and facility operations with respect to amendment injection rate, concentration, and quantity. The quality assurance for these activities is described in detail in the ISB GWMP (INEEL 2002d) for compliance and performance monitoring and in the ISB O&M Plan (DOE-ID 2002b) for facility operational activities.

13. SAFETY AND HEALTH PROGRAM

The TAN OU 1-07B HASP (INEEL 2002e) establishes the procedures and requirements that will be used for all activities associated with OU 1-07B. The major field activities for ISB are facility construction, system operations, maintenance, and groundwater sampling. The HASP includes a hazard assessment for all anticipated activities and specifies procedures and equipment to be used for worker safety.

The safety and health requirements for ISB remedial action activities include the areas of industrial safety, industrial hygiene, fire protection, radiation safety, and emergency preparedness. Safety and health requirements, in accordance with Occupational Safety and Health Act Standard 29 CFR 1910.120 and 1926.65, NOT IN REF LIST "Hazardous Waste Operations and Emergency Response," are designed and established to provide a safe and healthy work environment. Safety and health requirements are being implemented at the INEEL through the DOE Integrated Safety Management System and the Voluntary Protection Program. The Integrated Safety Management System and Voluntary Protection Program provide for the integration of hazard identification and mitigation into the work control process for construction, operations, and maintenance activities.

14. SCHEDULE AND BUDGET

This section addresses cost, schedule, and deliverables for ISB hot spot remediation activities. Also included is a cost comparison of the current project baseline and the cost estimate in the OU 1-07B ROD amendment (DOE-ID 2001a). The current project baseline includes a refined cost estimate for ISB construction based on the "In Situ Bioremediation Remedial Design, Test Area North, Operable Unit 1-07B (Draft)" (DOE-ID 2002a).

14.1 Record of Decision Cost versus Current Baseline

Out-year funding availability for RD/RA projects is subject to Congressional approval of DOE budgets; however, the DOE has identified adequate funding in existing budget plans for this project. Table 14-1 contains the project cost estimate from the OU 1-07B ROD amendment (DOE-ID 2001a). This estimate and the assumptions contained in the ROD amendment may be used for comparison throughout the project. Depending on the outcome of the specified ROD and RD/RA SOW (DOE-ID 2001b) decision points, the actual remediation costs are expected to be within -30 to +50% of the ROD cost estimate.

14.2 Cost Estimate

The Federal Acquisition Regulations, Subpart 36.203(c) (FAR 2002)states that a detailed cost estimate cannot be disclosed to the public until the contract is awarded. This RAWP is a public document and as such, cannot contain detailed cost information related to ISB construction, ISB activities, or for tasks which might be competitively bid. Table 14-2 provides a divisional breakdown of the estimated ISB construction costs. This estimate is based upon the ISB 90% design being provided with this RAWP. This estimate covers the cost of constructing the facility and ancillary features.

14.3 Schedule

The documents submitted to the EPA and IDEQ as deliverables are presented in Table 14-3, with the corresponding submittal dates, in accordance with Section XII of the FFA/CO (DOE-ID 1991). Milestone deliverable dates presented in Table 14-2 were established in the RD/RA SOW (DOE-ID 2001b), and where applicable, as modified by subsequent agency agreement.

Documents will have expedited and nonexpedited review and revision schedules. The review periods vary depending on the document. Draft primary documents (nonexpedited) have the standard 45-day review period. Secondary documents will have their standard 30-day review period. The DOE review will be concurrent with the EPA and IDHW review.

Figure 14-1 is the MNA RD/RA schedule containing the activities and interfaces necessary to accomplish the task detailed in this RAWP. The schedule ends with the completion of MNA performance operations; long-term operation schedule activities will be detailed in a future revision to this RAWP following issue of the MNA remedial action report.

Table 14-1. Operable Unit 1-07B cost summary.

Description	Baseline Cost Estimate[a, b, c] FY-99 ($)	ROD Cost Estimate[a, b, c] FY-99 ($)
ISB Design	155,900	9,097
ISB Construction	819,000[d]	77,871
ISB Operations and Maintenance (FY-04 to FY-18)	3,002,076[e]	2,868,474
ISB Deactivation, Decontamination, and Dismantlement	66,872[f]	29,692
Common Elements (Sunk Costs, NPTF Operations, MNA Operations)	33,931,322	33,931,322
TOTAL	37,975,170[g]	35,414,898

a. Dollars are net present value with a discount rate of 7%.

b. The baseline cost estimate includes actual cost through FY-01 and baseline-estimated cost for FY-02 through FY-18 (except as noted).

c. Costs were converted to FY-99 dollars based on a 7% discount rate.

d. Includes $458k for three new ISB wells. Note – the ROD cost estimate did not include well drilling costs.

e. $450,000 + 147,000 annually-first 5 years; $150,000 + 147,000-last 10 years.

f. Assumes ISB D&D&D would be completed in FY-2018.D&D&D in the ROD cost estimate was scheduled for FY-2031.

e. The ROD amendment cost estimate was $35,414,898.

Table 14-2. In Situ Bioremediation 90% construction cost estimate.

Operation	Cost ($)
Site Work	10,000
Concrete	9,000
Building/Enclosure	212,000
Well head Enclosures	15,000
Process System	100,000
Exterior Piping	49,000
Subtotal Direct Construction Cost[a]	395,000
Contingency (20%)	79,000
Reinjection Well and Monitoring Well	600,000
TOTAL	1,074,000

a. Direct construction costs do not include O&M contractor adders.

Table 14-3. Agency deliverable documents.

Deliverable	Planned Submittal Date	Enforceable Submittal Date	Review Duration (days)	Document Type
Distal Zone Remediation				
MNA RAWP	January 2003	September 2002	45	Primary
MNA OM&M Plan	January 2003	March 2004	45	Primary
MNA Remedial Action Report[a]	TBD	TBD	45	Primary
ISB Performance Report	May 2002	N/A	INFO	External release
OM&M Plan, Revision[b]	TBD	TBD	45	Primary
MNA Annual Performance Report	July/yearly	N/A	INFO	External release
O&M Report[c]	TBD	TBD	45	Primary
Remedy Performance Evaluation				
Remedy Performance Summary Report[d]	Annual/ Periodic	N/A	INFO	External release

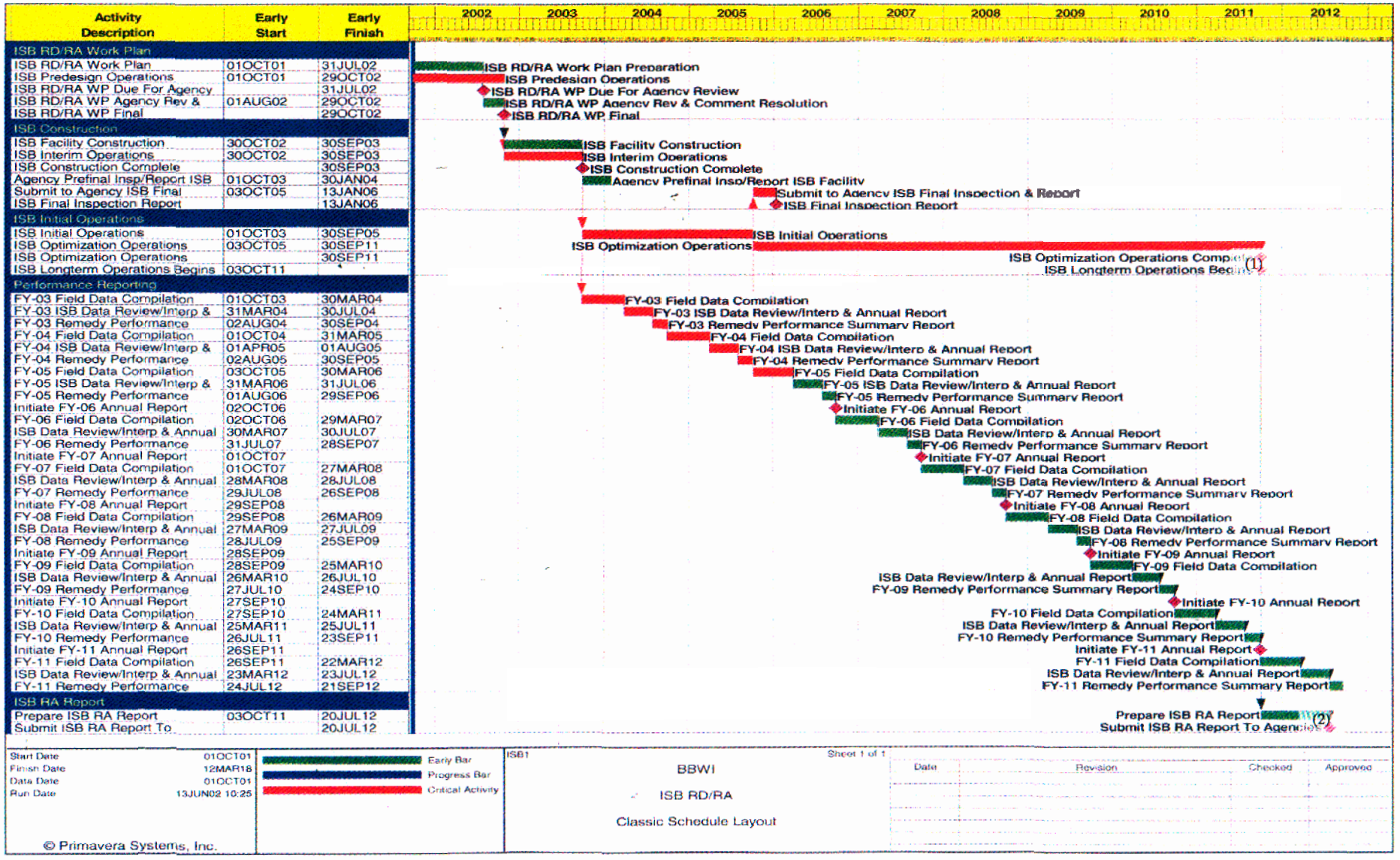
INFO = for information
N/A = not applicable
TBD = to be determined

a. Document deliverable date (to be determined) in the ISB Prefinal Inspection Report.

b. Deliverable date (to be determined) set in the MNA Remedial Action Report.

c. Deliverable date set in the MNA O&M Plan (DOE-ID 2002b).

d. Annual report first 5 years, periodic thereafter.



Notes:

(1) Duration of long-term operations is not shown on the schedule; a revised schedule will be prepared as part of the Remedial Action Report indicating the proposed completion date of the remediation.

(2) The actual submittal date for the Remedial Action Report shall be determined according to the ISB Prefinal Inspection Report.

Figure 14-1. In situ bioremediation remedial design/remedial action schedule.

15. REFERENCES

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Appendix A

Agency Comments and Resolutions for the In Situ Bioremediation Remedial Action Work Plan (Draft)

Table A-1. EPA Region 10 comments on the ISB RAWP (Draft).

Comment No.	Page No.	Doc/Sect.	Comment	Resolution
EPA-1. **	2-2	DOD/ID-11015 ' 2.2	The Compliance objectives identified apply only to VOC COCs and do not address the ^{90}Sr & ^{137}Cs, which will continue to be above MCLs beyond the restoration timeframe.	There are two requirements governing the monitoring of radionuclides. (1) The first is in support of the evaluation of meeting the overall RAO requirement that radionuclides (all COCs) attenuate by 2095. The objectives, requirements and objectives for this monitoring are being developed and documented in the MNA Work Plan. (2) The second is in support of evaluation of medial zone source control. Medial Zone source control monitoring evaluates the potential for a slug of radionuclides to migrate down gradient to the NPTF. This evaluation may trigger the NPTF contingent remedy, the ASTU. To address this comment a table has been prepared and inserted in the ISB RAWP Section 2 which cross walks the various PM/CM requirements to their respective remedy components. Monitoring for radionuclides is being added to the ISB RAWP groundwater-monitoring list of analytes in support of the two requirements mentioned above.
EPA-2.	2-4	DOD/ID- 11015 TBL 2-1	Add ^{90}Sr and ^{137}Cs to the COCs identified under Long- term Operations performance.	Please see response to EPA-1. A crosswalk table has been added to section 2, which identifies the various monitoring requirements and to which remedial component these requirements belong.
EPA-3. **	3-1	DOD/ID- 11015 ' 3.1.2.2	As entire regulatory sections are referenced in Table 3-1, it should be stated that only the substantive portions of the requirements are ARARs. Also, any off-site management of wastes are subject to the Off-Site Rule.	Agree – Section will be modified to speak to the substantive portions of the ARARs.
EPA-4.	4-15	DOD/ID- 11015 ' 4.4.2	There should be a reference to the ISB Remedial Design	A reference will be added.

Table A-1. (continued).

Comment No.	Page No.	Doc/Sect.	Comment	Resolution
EPA-5. **	7-1	DOD/ID- 11015 General	The maintenance of the ASTU in standby should also be covered in this section	Suggest that ASTU standby be addressed in the NPTF RAWP and O&M Plan.
EPA-6. **	7-5	DOD/ID- 11015 ' 7.6	The specific institutional controls that apply to 1-07B In Situ Bioremediation need to be described here.	A list of institutional controls will be added.
EPA-7. **	7-5	DOD/ID- 11015 ' 7.7.1	There should be a reference to the enforceable date of March 2004 for the PreFinal Inspection Report.	A section will be added which addresses the Prefinal inspection report.
EPA-8.	8-3	DOD/ID- 11015 Tbl 8-1	Add ^{90}Sr and ^{137}Cs to the COCs identified under Long- term Operations performance.	These COCs will be added as a monitoring requirement for MNA covered under the ISB sampling regime.
EPA-9.	10-2	DOD/ID- 11015 '10.2	There is no "and" in the Toxic Substances Control Act 15 U.S.C. 2601 to 2671.	Will remove "and".
EPA-10. **	12-1	DOD/ID- 11015 ' 12	Quality assurance requirements established in DOE-ID 2000b are generic and are supposed to be supplemented for site-specific activities. For example, given the critical nature of the compliance monitoring samples it may be advisable to increase the number of field blanks &/or duplicates.	Comments incorporated. Sampling for compliance monitoring will be considered a discrete sampling round and one field blank and one field duplicate will be collected for each compliance-sampling round. This will result in a frequency of one field blank and one field duplicate per two compliance samples. Additionally, the completeness requirement for compliance monitoring will be revised to 100%.
EPA-11.	14-2	DOD/ID- 11015 Tbl 14-1	This table should also include a column to identify ROD Amendment estimated costs to allow comparison with current cost estimate.	Table will be modified to allow for the comparison.

Table A-1. (continued).

Comment No.	Page No.	Doc/Sect.	Comment	Resolution
EPA-12. **	B-4	DOD/ID- 11015 Tbl B-1 & B-2	The connection of the decisions in Table B-1 with the analytes in Table B-2 is unclear, especially the chloroethenes vs VOCs and whether the definition of "definitive" for operational trends is or should be, equivalent to the definition of "definitive" for compliance monitoring.	Comments incorporated. (1) "Chloroethenes" will be globally changed to "VOCs". (2) The QAPjP definition of "definitive" data is provided on the preceding page. Table B-1 shows that definitive data will be determined only for compliance monitoring, not for performance (operational trends) monitoring.

Table A-2. IDEQ comments on the ISB RAWP (Draft).

Comment No.	Page No.	Section	Location	Comment	Resolution
IDEQ-1.	1-2	Section 1.1	1st Paragraph, 2nd Sentence	This sentence should state that this will be the final action for this site if this remedial action is successful in meeting RAOs.	Comment noted, sentence has been deleted
IDEQ-2.	1-3	Section 1.1	Figure 1-1	It is suggested that the wording in the fourth bullet of the block titled "Restoration by In Situ Bioremediation at the Hot Spot" be changed to language more specific to the site, as the phrase "several hundred feet" could be misinterpreted. It is suggested that the phrase be changed to potential well locations such as TAN-28 or TAN-29.	No change, directly from the ROD Amendment.
IDEQ-3.	1-4	Ibid.	Bullet 1	The first description under this bullet requires additional justification. It should state that the ASTU will reinject the water back in TAN-31, an upgradient well. Also, additional cost for piping to meet this contingency needs to be addressed in this plan.	This section of the RAWP is a reproduction of language used in the ROD Amendment. Suggest that the details for justification, requirements and design of the NPTF Contingency be dealt in the NPTF Work Plan and O&M Plan.
				The second description under this bullet states that if "MNA will not restoe the distal zone of the plume within the restoration time frame, pump-and-treat units will be designed, constructed, and operated in the distal zone to remediate the plume." Pump-and-treat units certainly are a viable approach to use for the distal part of the plume. However, this phrase does imply that the units will be aboveground, similar in concept to the NPTF. It is suggested that this phrase be amended to also include in situ treatment approaches such as in-well air sparging or other developing technologies that might be applicable for treating this low concentration, large volume problem.	The second description is directly from the ROD Amendment. Suggest crafting language in the upcoming MNA Work Plan to address this concern.

Table A-2. (continued).

Comment No.	Page No.	Section	Location	Comment	Resolution
IDEQ-4.	2-1	Section 2.1	Last Paragraph	There is basic agreement that radionuclides tend to bind to the natural substate matrix. However, there remain concerns that the amendments may enhance migration of radionuclides, specifically Sr-90. This concern must be addressed through monitoring in the hot spot as well as downgradient.	There are two requirements governing the monitoring of radionuclides. (1) The first is in support of the evaluation of meeting the overall RAO requirement that radionuclides (all COCs) attenuate by 2095. The objectives, requirements and objectives for this monitoring are being developed and documented in the MNA Work Plan. (2) The second is in support of evaluation of medial zone source control. Medial Zone source control monitoring evaluates the potential for a slug of radionuclides to migrate down gradient to the NPTF. This evaluation may trigger the NPTF contingent remedy, the ASTU. To address this comment a table has been prepared and inserted in the ISB RAWP Section 2 which cross walks the various PM/CM requirements to their respective remedy components. Monitoring for radionuclides is being added to the ISB RAWP groundwater-monitoring list of analytes in support of the two requirements mentioned above.
IDEQ-5.		Section 2.2	Compliance Objective	Verification of radionuclide concentrations near the source needs to be a compliance objective.	Comment incorporated; please see response to IDEQ-4.

Table A-2. (continued).

Comment No.	Page No.	Section	Location	Comment	Resolution
IDEQ-6.	2-3	Section 2.3	Last Paragraph	The next to last sentence is incomplete. It is not clear what will be evaluated. Please complete the thought.	Will seek to clarify.
IDEQ-7.	2-5	Ibid.	Figure 2-1	The third diamond, "Initial Operations," has two bulleted items. The second bullet states "Find Agency Inspection and Report." It is assumed the intent is to refer to a "Final Agency Inspection and Report" but if not, please clarify. Otherwise, please change the term used in the draft.	Assumption is correct the text will be changed.
IDEQ-8.	3-2	Section 3	Table 3-1	It is not clear why the Idaho Ground Water Quality Rule is not cited in this table. It is assumed it is not cited because it was not included in the amendment to the ROD for this OU.	This rule was not issued at the time of the 1995-ROD. It is not in the ROD Amendment because there is no loss of protectiveness and there are no health based issues.
IDEQ-9.	4-1	Section 4.1.1.1	Paragraph 1	The second sentence refers to "ranging" but the correct term is "range." Please correct this minor error.	Text will be modified.
IDEQ-10.	4-12	Section 4.3	Table 4-2	The column for "Lab" shows footnote "(3)" in several locations indicating to the reader that the lab will be placed in a "Heated tanker," which does not seem reasonable. Please clarify the intent of this footnote as shown in this table.	Text will be modified.
IDEQ-11.	4-15	Ibid.	Table 4-3	The table appears to relay capital construction cost plus long-term operations and maintenance as stated in the text on page 4-11, but the column headers indicate that only construction costs are presented for the alternatives. Also, the net present value (NPV) for the original alternative is assumed to be the value presented in the ROD Amendment, but the value is not consistent between the table and the amendment. Please make these corrections as needed. The costs for the alternatives should be documented in an appendix or EDF as simple table or spreadsheets so the reviewer can track the cost breakdown. As	This table will be clarified.

Table A-2. (continued).

Comment No.	Page No.	Section	Location	Comment	Resolution
				presented, this breakdown is not apparent.	
IDEQ-12.	7-5	Section 7.6		Please modify the statement in the last sentence to make it clear to the reader that "prevention of well drilling" does not apply to wells needed for the remedial action.	Text will be modified.
IDEQ-13.	8-3		Tables 8-1 and 8-2	Add Sr-90 and Cs-137 to analyte list.	Comment incorporated.
IDEQ-14.	B-4	Appendix B	Table B-1	Radionuclides need to be added under "Data Required."	Comment incorporated.
IDEQ-15.	B-5	Appendix B	Table B-2	The MCL for vinyl chloride is 2 µg/L, therefore, the action level needs to be changed.	Comment incorporated.
IDEQ-16.	B-5	Appendix B Section 1.3	Table B-2	An MDL is not presented for cis-DCE using method SW-846 8260B. Please add an MDL, or if a value is not available, please state in the space or by using a footnote.	Comment incorporated.
IDEQ-17.	B-7	Ibid.	Section 1.5	Although it may not be necessary to provide details in this appendix, the Agencies should agree beforehand how values below the MDL will be reported and then used in the agreed to statistical measures that will be used to determine success	Comment noted.
IDEQ-18.		Section 9.1		Define parameters for liquid waste stream compatibility with NPTF operations	A statement will be added which requires that new waste streams be evaluated against the Waste Management Plan.

Appendix B

Agency Comments and Resolutions for the In Situ Bioremediation Remedial Action Work Plan (Draft Final)

Table B-1. Environmental Protection Agency Region 10 Comments for the In Situ Bioremediation Remedial Action Work Plan (Draft Final).

Comment No.	Page No.	Doc/Section	Comment	Resolution
EPA-1.	3-1	DOE/ID-11015 Sect 3.1	It should be pointed out that what is written here are excerpts from the September 2001 ROD Amendment as this document does not have the authority to modify the ROD.	Agree; a sentence has been added to make this point.
EPA-2.	4-9	DOE/ID-11015 Sect 4.2 4th Bullet	The ISB should be designed to operate for a minimum of 15 years and it should be recognized that its operation might continue with replacement parts as long as the RAO's are not met.	Agree; added a bullet to Section 4.2 indicating this parameter.
EPA-3.	8-3	DOE/ID-11015 Table 8-2	There should be a footnote identifying that the long-term compliance monitoring sampling strategy will be submitted in the Remedial Action Report, a primary document.	A footnote was added to Table 8-2 indicating that the long-term monitoring strategy will be submitted as part of the ISB Remedial Action Report. Long-term radionuclide monitoring requirements shall be identified and delineated in the respective monitoring programs. The crosswalk table (Table 2-2) maps the various programs.

Table B-2. IDEQ Comments for the ISB RAWP (Draft Final).

Comment No.	Page No.	Doc/Section	Comment	Resolution
IDEQ-1.	8-3	DOE/ID-11015 Table 8-1	Monitoring well TAN-27 is shown as a monitoring well in Figure 4-2 but is not in Table 8-1 on page 8-3. Please add TAN-27 to Table 8-1 to provide data on the flank of the plume as potential hydraulic charges are made to the system via modification to the ISB system.	Agree; TAN-27 will be added back.

Appendix C

In Situ Bioremediation Compliance with Applicable or Relevant and Appropriate Requirements

Table C-1. Compliance with regulatory requirements.

Category	Type	Regulatory Requirements	Implementation Strategy
Hazardous Waste Determination	Action	A person who generates a solid waste must determine if the waste is a hazardous waste by using the following method: 1) Determine if the waste is excluded under 40 CFR 261.4 2) Determine if the waste is listed as a hazardous waste in 40 CFR 261, Subpart D 3) For the purposes of compliance with 40 CFR part 268, or if the waste is not listed in subpart D of 40 CFR part 261, the generator must then determine whether the waste is identified in subpart C (characteristic) of 40 CFR part 261. IDAPA 58.01.05.006 {40 CFR 262.11}	Any waste streams generated during the remediation process for storage and/or disposal will have a hazardous waste determination performed. If needed, sampling will be conducted in accordance with a task specific sampling and analysis plan. All generated waste will be packaged, handled, and stored in accordance with the Phase C Waste Management Plan. Waste minimization activities will be implemented in accordance with the INEEL Reusable Property, Recycle Materials and Waste Acceptance Criteria. Trained personnel will inspect and ensure the CERCLA Waste Storage Units are in compliance with all applicable regulations.
General Waste Analysis	Action	General facility standards require that operators of a facility must obtain chemical and physical analyses of a representative sample of each hazardous waste to be treated, stored, or disposed of at the facility prior to treatment, storage, or disposal. The analysis may include existing published or documented data on the hazardous waste or on hazardous waste generated from a similar process. At a minimum, the analysis must contain all the information which must be known to treat, store, or dispose of the waste in accordance with this part and part 268 of this chapter. IDAPA 58.01.05.008 {40 CFR 264.13}	Waste stream management requirements are based on a waste evaluation supported by a project sampling and analysis plan and/or process knowledge. This information will provide the basis for determining; container requirements, storage requirements, labeling requirements, and treatment and disposal requirements. All waste (both radionuclide and VOC) generated during remediation operations will be managed through facility procedures in accordance with the Phase C Waste Management Plan.
General Facility Standards (Preparedness and Prevention)	Action	Treatment, Storage, and Disposal (TSD) operators must design, construct, maintain and operate facilities to minimize the possibility of fire, explosion or any unplanned sudden or non-sudden release of hazardous waste to air, soil, or surface water which might threaten human health or the environment. IDAPA 58.01.05.008 {40 CFR 264.31 through .35 and .37}	New and existing facilities will continue to be designed, inspected and operated in compliance with site procedures and the requirements of this section. New treatment systems and any modifications to existing facilities as well as current operations will consider the design and operational requirements of these sections when developing the design requirements.

Table C-1. (continued).

Category	Type	Regulatory Requirements	Implementation Strategy
Closure Performance Standards	Action	The owner or operator must close the facility in a manner that: Minimizes the need for further maintenance, Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface water or to the atmosphere, and Complies with the closure requirements of this subpart. IDAPA 58.01.05.008 {40 CFR 264.111} During the partial and final closure periods, all contaminated equipment, structures and soils must be properly disposed of or decontaminated unless otherwise specified in Sections 264.197, 264.228, 264.258, 264.280 or Section 264.310. By removing any hazardous wastes or hazardous constituents during partial and final closure, the owner or operator may become a generator of hazardous waste and must handle that waste in accordance with all applicable requirements of part 262 of this chapter. IDAPA 58.01.05.008 {40 CFR 264.114}	Once remediation activities have achieved compliance with remediation goals, closeout procedures will be implemented. An evaluation of the equipment and storage areas will determine closure requirements and management of the materials, pump-and-treat equipment, and associated ancillary piping. Emphasis will be placed on minimal site O&M at completion of closure. All equipment, materials, and associated debris generated during project closeout will be adequately characterized to determine waste management requirements.
Container Management	Action	Remediation wastes will be kept in container meeting the requirements of 40 CFR 264.171; Wastes will be stored with compatible containers; Containers will be properly managed; and The storage facility will be subject to inspections under 40 CFR 264.174. The storage area containment system will be in accordance with 40 CFR 264.175.	Characterization results via process knowledge or analytical results will dictate the packaging requirements, determine storage requirements, and compatibility with other wastes. Waste containers will be properly lableled and managed in accordance with existing operating procedures. All containerized waste will be subject to RCRA storage facility inspection requirements. If required, the storage containers will be stored within the CERCLA Waste Storage Area.

Table C-1. (continued).

Category	Type	Regulatory Requirements	Implementation Strategy
		IDAPA 58.01.005.008 {40 CFR 264 Subpart I}	Containers used to transport water extracted during groundwater sampling will not be double walled containers. If water is stored in these containers (>3 days) they will be placed in a container storage area with secondary containment. Any new treatment systems and any future facility modifications will be designed to provide adequate containment. These requirements will be covered and implemented through the Phase C Waste Management Plan and respective Phase C Remedial Designs.
Land Disposal Restriction	Action	IDAPA Regulation 58.01.05.011 identifies that all of 40 CFR Part 268 and all subparts are herein incorporated by reference as provided in 40 CFR, revised as of July 1, 1994, except for 40 CFR Parts 268.5, 268.6, 268.42(b) and 268.44. Except as specifically provided otherwise in this part or part 261 of this chapter, the requirements of this part apply to persons who generate or transport hazardous waste and owners and operators of hazardous waste treatment, storage, and disposal facilities. Restricted wastes may continue to be land disposed as follows: Where persons have been grated an extension to the effective date of a prohibition under subpart C of this part or pursuant to Section 268.5, with respect to those wastes covered by the extension; Where persons have been granted an exemption from a prohibition pursuant to a petition under Section 268.6, with respect to those wastes and units covered by the petition; Wastes that are hazardous only because they exhibit a hazardous characteristic, and which are otherwise prohibited from land disposal under this part, are not prohibited from land disposal if the wastes:	Wastes generated as a result of remediation efforts will be characterized for determining management requirements. Additionally, each waste stream will be evaluated to determine the applicability of LDRs. Waste streams subject to LDRs will be segregated and consolidated with compatible waste streams, as appropriate, when similar treatment technologies can be utilized. Waste streams generated from implementation of treatment technologies will be captured and appropriately managed based on classification.

Table C-1. (continued).

Category	Type	Regulatory Requirements	Implementation Strategy
		Are disposed into a nonhazardous or hazardous injection well, as defined in 40 CFR 144.6(a); and Do not exhibit any prohibited characteristic of hazardous waste at the point of injection; and If at the point of generation the injected wastes include D001 High TOC subcategory wastes or D012-D017 pesticide wastes that are prohibited under section 148.179(c) of this chapter, those wastes have been treated to meet the treatment standards of Section 268.40 before injection. IDAPA 58.01.05.011	
Water Quality	Action	Contaminated groundwater may not be injected back into the aquifer in which it came unless the groundwater is treated to substantially reduce hazard constituents prior to such reinjection. Section 3020 of RCRA.	Any extracted groundwater obtained during performance of OU 1-07B remedial activities will be processed through the NPTF prior to reinjection. Processing through the NPTF will substantially reduce the hazardous constituents.
Water Quality (Underground Injection Control)	Action	No chemical contaminants at concentrations above MCLs, or above the contaminant concentration of the receiving water can be injected in to the aquifer. No radionuclides above MCLs, or hazardous waste, can be injected into the aquifer. IDAPA 37.03.03	The design of the NPTF has incorporated the substantive requirements specified within this IDAPA regulation.
Water Quality (Monitoring)	Action	Monitoring, record keeping and reporting may be required if the well could adversely affect a drinking water source or if injecting a contaminant that could have an unacceptable effect upon the quality of the groundwaters of the state. The state may require (where appropriate), but is not limited to, the following: Any injection authorized by the state shall be subject to monitoring and record keeping requirements as conditions of the permit; The frequency of required monitoring shall be specified in the permit;	Any systems or components that inject materials into the aquifer during the remedial activities will meet these requirements as established in the individual work plans. Periodic monitoring will be performed to show compliance with this regulation.

Table C-1. (continued).

Category	Type	Regulatory Requirements	Implementation Strategy
		All monitoring tests and analysis required by permit conditions shall be performed in a state certified laboratory or other laboratory approved by the state; Any field instrumentation used to gather data, when specified as a condition of the permit, shall be tested and maintained in such a manner as to ensure the accuracy of the data; and All samples and measurements taken for the purpose of monitoring shall be representative of the monitoring activity and fluids injected. IDAPA 37.03.03.055.01	

Appendix D

Data Quality Objective Development

Appendix D

Data Quality Objective Development

D-1. DATA QUALITY OBJECTIVES

The DQO process is a series of planning steps designed to ensure that data of known and appropriate quality are obtained to support remedial response decisions (EPA 1993). The process uses qualitative and quantitative statements intended to clarify study objectives; define appropriate data types, determine appropriate conditions from which to collect the data, and specify acceptable levels of decision errors. The outputs of each step are then used as inputs in designing the sampling plan.

Environmental Protection Agency data quality objective guidance (EPA 1993) generally recommends that a seven-step process be used to implement the process to design both qualitative and quantitative (statistically-based) sampling and analysis plans for all CERCLA responses. This GWMP will utilize both qualitative and quantitative analysis of groundwater monitoring results, and of numerical modeling results, to determine progress of the ISB component of the overall OU 1-07B remedy. Not all steps apply to all data collection activities. The steps of the DQO process (EPA 1993) are as follows:

1. **State the problem**, including identifying the data users, the planning team, the primary decision maker, resources and deadlines

2. **Identify the decision to be made,** including the principal study questions, alternative actions that could result from resolution of the principal study questions, and formulate and prioritize decision statements

3. **Identify inputs to the decision**, including required data types and sources, action levels, and analytical methods

4. **Define study boundaries,** including spatial and temporal aspects

5. **Develop a decision rule,** including (where appropriate) specifying the statistical parameter that characterizes the population, and (where appropriate) action levels for the statistical tests

6. **Specify limits on decision errors**

7. **Design the data collection program**, which will be implemented through this GWMP.

The first six steps are discussed in Sections 1.1 through 1.6 of this appendix, and the seventh step is addressed in Section 3 of this RAWP.

D-1.1 State the Problem

This level of the analysis summarizes the problem requiring new data, and identifies resources available to resolve the problem. The problems to be addressed in this GWMP are the OU 1-07B ISB compliance and performance objectives defined in Section 2.2 of the RAWP and listed below.

Compliance objectives include the following:

- Reduce downgradient flux from the hot spot such that VOC concentrations are less than MCLs

- Reduce crossgradient flux from the hot spot such that VOC concentrations are less than MCLs
- Maintain the reduction of downgradient and crossgradient flux from the hot spot such that concentrations of VOCs are below MCLs.

Performance Objectives include the following:

- Achieve electron donor distribution throughout the hot spot
- Achieve source degradation.

Remedy Component Performance Reports will be prepared annually between the years 2002 and 2007. These reports will present both performance and compliance monitoring data. Additionally, a numerical simulation for the ISB remedial action component will be performed annually to determine whether or not the remedial action is progressing as predicted.

Regarding the performance and compliance monitoring strategies, the RD/RA SOW states: "Perhaps the most important aspect of this activity is the development of the evaluation process and decision logic to be used in determining the performance of each remedial component. If the evaluation process shows that the RAO will not be met, then the project and the Agencies will reconsider the implementation of the remedial component and determine, in accordance with the decision logic, whether a different operational strategy would make the remedial component successful at achieving the RAOs." The evaluation process considers qualitative and quantitative assessment of the data, as well as results of numerical modeling.

D-1.2 Identify the Decision

This step identifies the decisions that must be made, based on results of groundwater monitoring, and who will use the data. The immediate data users will be INEEL scientists and engineers analyzing trends to assess performance of ISB and electron donor distribution. Ultimate data users include INEEL and regulatory agency personnel who must periodically evaluate progress of the remedy relative to the RAOs and performance criteria cited above.

Based on the information provided in Section 2 of this RAWP and the remedy implementation sequence shown in Figure 1-1 of the RAWP, decisions can be summarized as follows:

- Determine whether operational changes are required by routinely monitoring performance of the ISB system with respect to indicator parameters including VOCs, tritium, ethene/ethane/methane, redox parameters, electron donor, bioactivity, and nutrients.
- Determine whether or not downgradient flux of contaminants from the hotspot has been cut off, as evidenced by VOC concentrations below MCLs at TAN-28 and -30A.
- Determine whether or not crossgradient flux of contaminants from the hotspot has been cut off, as evidenced by VOC concentrations below MCLs at monitoring wells PMW-1 and PMW-2.
- Determine whether long-term operations are complete (the compliance criteria for long-term operations will be specified in the ISB Remedial Action Report).

D-1.3 Identify Inputs to the Decisions

This step identifies information required to make the decision, including specific data types, quality levels, and quantity needed to support decisions. This stage of analysis must ensure that sufficient data are obtained of the required types and of a quality appropriate for the data uses. Results of this stage are typically used to define quality levels to be applied to the entire data collection effort, from sampling through analysis and data validation. Specifying unnecessarily stringent data quality costs the project time and money. Specifying insufficiently stringent data quality may result in failure to meet project objectives.

The EPA and QAPjP define data quality levels as screening or definitive. Screening data are generated using rapid, less precise analytical methods with less rigorous sample preparation. Screening data both identify and quantify analytes, though quantification may be relatively imprecise. Screening data were used during the OU 1-07B ISB field evaluation and predesign phases to monitor ISB performance, as discussed in the FY 2001 ISB annual report (INEEL 2002a). Screening data are adequate for performance monitoring, based on the results of that report. The EPA definition states that at least 10% of the screening data are confirmed using definitive analytical methods and QA/QC procedures and criteria. Screening data without associated confirmation data are not considered to be data of known quality.

Definitive data are generated using rigorous analytical methods such as approved EPA, American Society of Testing and Materials International, or other well established and documented test methods. Definitive data both identify and quantify analytes with relatively high precision and accuracy, and are typically used for compliance monitoring. Definitive data have been used during the OU 1-07B field evaluation and predesign phases for compliance monitoring, and to confirm screening data. Definitive analytical methods produce tangible hardcopy, or electronic format, raw data (e.g. chromatograms, spectra, and digital readout values). Data not obtained or reported in these formats are documented in logbooks.

Inputs to each of the four decisions stated previously, including data required, data uses, and minimum data quality levels, are summarized in Table D-1. Requirements for decision input data, including action levels, analytical methods, method detection limits and data quality levels, are summarized in Table D-2.

D-1.4 Define Study Boundaries

The ISB component of the remedial action will focus on the OU 1-07B hotspot area (as defined in the ROD amendment) and background wells located and screened in uncontaminated portions of the aquifer. The remedial action duration is estimated at 30 years, beginning in 2003, but will continue until the RAO is met.

Table D-1. Decision inputs.

Decision	Data Required	Data use	Minimum Data Quality Level Required
1. Determine whether operational changes are required by routinely monitoring performance of the ISB system	VOCs Tritium Ethene/ethane/methane Redox indicators Bioactivity indicators Electron donor Nutrients	Performance monitoring-Trends in performance indicators (discussed in ISB O&M Plan) will be assessed. No quantitative action levels specified.	Screening
2. Determine whether axial flux of contaminants from the hotspot has been cut off, as evidenced by chloroethene concentrations below MCLs at TAN-28 and -30A.	VOCs	Compliance monitoring-VOC concentrations at specified locations will be compared to MCLs.	Definitive
3. Determine whether transverse flux of contaminants from the hotspot has been cut off, as evidenced by chloroethene concentrations below MCLs at PMW-1 and PMW-2.	VOCs	Compliance monitoring-VOC concentrations at specified locations will be compared to MCLs.	Definitive
4. Determine whether long-term operations are complete (the compliance criteria for long-term operations will be specified in the ISB Remedial Action Report).	VOCs	Compliance monitoring-TBD	TBD

ISB = in situ bioremediation VOC = volatile organic compounds O&M = operation and maintenance
MCL = maximum contaminant level TBD = to be determined

Table D-2. Data requirements for decision inputs.

Analyte	Action Level	Analytical Method	MDL[a,b]	Analytical Data Quality Level Attainable
VOCs				
TCE	5 ug/L	EPA 524.2 wide-bore capillary column	0.19 ug/L	Definitive
		SW-846 8260B	5 ug/L	Definitive
		SPME-GC-ECD	10 ug/L	Screening[c]
PCE	5 ug/L	EPA 524.2 wide-bore capillary column	0.14 ug/L	Definitive
		SW-846 8260B	5 ug/L	Definitive
		SPME-GC-ECD	10 ug/L	Screening[c]
cis-DCE	70 ug/L	EPA 524.2 wide-bore capillary column	0.12 ug/L	Definitive
		SW-846 8260B	5 µg/L	Definitive
		SPME-GC-ECD	10 ug/L	Screening[c]
Trans-DCE	100 ug/L	EPA 524.2 wide-bore capillary column	0.06 ug/L	Definitive
		SW-846 8260B	5 ug/L	Definitive
		SPME-GC-ECD	10 ug/L	Screening[c]
Vinyl Chloride	2 ug/L	EPA 524.2 wide-bore capillary column	0.17 ug/L	Definitive
		SW-846 8260B	5 ug/L	Definitive
		SPME-GC-ECD	10 ug/L	Screening[c]
Dissolved Gases				
Ethene	N/A	GC-FID	10 ug/L	Screening
Ethane	N/A	GC-FID	10 ug/L	Screening
Methane	N/A	GC-FID	10 ug/L	Screening
Redox Indicators				
Sulfate	N/A	Hach Method 8051	4.9 mg/L	Screening
Iron	N/A	Hach Method 8146	0.03 mg/L	Screening
COD	N/A	Hach Method 10067	14 mg/L	Screening
pH	N/A	Hydrolab		Screening
ORP	N/A	Hydrolab		Screening

Table D-2. (continued).

Analyte	Action Level	Analytical Method	MDL[a,b]	Analytical Data Quality Level Attainable
Electron Donor				
Lactate	N/A	Ion Chromatography	5 mg/L	Screening
Acetate	N/A	GC/FID	5 mg/L	Screening
Propionate	N/A	GC/FID	5 mg/L	Screening
Butyrate	N/A	GC/FID	5 mg/L	Screening
Nutrients				
Ammonia Nitrogen	N/A	Hach Method 10023 (for low range) Hack Method 10031 (for high range)	0.02 mg/L	Screening
Orthophosphate	N/A	Hach Method 8048	0.05 mg/L	Screening
Bioactivity Indicators				
Alkalinity	N/A	Hach Method 8203		Screening
Specific Conductivity	N/A	Hydrolab		Screening

a: Method Detection Limits (MDLs) for EPA method organics and radionuclides are from DOE/ID-10587, *QAPjP for WAGs 1, 2, 3, 4, 5, 6, 7, 10 and Inactive Sites*; for Hach methods are from the Hach Manual; for Hydrolab parameters are from the Hydrolab manual; for SPME organics, lactate/acetate/propionate/butyrateare from Cathy Rae, personal communication.

b: Per DOE/ID-10587, "Detection limits must not exceed one tenth the risk-based or decision-based concentrations for the contaminants of concern." This applies to definitive attainment or compliance monitoring only, for purposes of this GWMP.

c: the SPME-GC-ECD results do not meet the QAPjP definition of definitive data as "…generated using rigorous analytical methods, such as approved EPA or ASTM reference methods or well-established and documented test methods." and are therefore considered screening data.

SPME-GC-ECD = solid-phase microextraction-gas chromatography-electron capture detector, an analytical method used during the ISB field evaluation and pre-design phases for chloroethene determinations.

GC-ECD = gas chromatography-electron capture detector

D-1.5 Develop a Decision Rule

Decision rules should contain four main elements (EPA 1994) including the following:

- The *parameter of interest* (e.g., a descriptive measure that specifies the characteristic or attribute that the decision maker would like to know about a statistical population)
- The *scale of decision making* (i.e., the smallest, most appropriate subset of the data for which separate decisions will be made)
- The *action level, which* is a measurement threshold value of the parameter of interest that provides the criterion for choosing among alternative actions (e.g., a regulatory standard or other risk-based level)
- The *alternative actions*, which are the actions that the decision maker would take depending on the true value of the parameter of interest.

Decisions 2 and 3 have quantitative action levels; therefore, quantitative decision rules are defined for these. Decision 1 does not have quantitative action levels, thus, performance trends will be tracked to support this decision. (These performance trends will be assessed and reported in ISB annual reports.) The OU 1-07B ISB remedial action report (INEEL 2002a) will define Decision Rule 4, and methods for determining the end of the remedial action.

EPA (1992) offers guidance on assessing multiple wells individually versus as a group. If assessed individually, then the site can be declared clean only if the groundwater in each well attains the cleanup standard. The greater the number of wells tested, the greater the likelihood of a false negative decision in at least one well, resulting in an overall nonattainment decision. However, in spite of false negative decisions, assessing all wells individually can result in relatively greater protection of human health and the environment because all concentrations must attain the cleanup standard.

Alternatively, all wells may be tested as a group. Measurements from each well are combined into a summary statistic for each sampling event. The groundwater for the group of wells would be declared to attain the cleanup standard if the summary statistic was significantly less than the cleanup standard. The summary statistic could be the average (mean) for the group or the maximum concentration from the group of wells. Using the maximum for the group means that each well individually must attain the standard.

Based on cost-effective protection of human health and the environment, the decision rule will utilize the average concentration for each well group (i.e., TAN-28 and –30A; Wells PMW-1 and –2). Use of results less than detection limits in these calculations will be discussed and decided with the Agencies before determining compliance with a decision rule, or determining when the remedy is complete.

The EPA (1992) further suggests specific parameters to test when comparing the cleanup standard to the mean concentration of a chemical with chronic effects, with respect to the variability expressed as coefficient of variation and concentration range of the data. Suggested parameters and values are shown in Table D-3.

Less than 30% of ISB sampling locations might be expected to have VOC concentrations below detection limits during attainment monitoring, given that the required detection limits are an order of magnitude below MCLs. Coefficients of variation are expected to be intermediate. Therefore, the suggested cleanup standard attainment test parameter is the mean or upper percentile.

Table D-3. Recommended cleanup standard attainment test parameters relative to data properties.

Coefficient of Variation	Proportion of the Data with Concentrations Below the Detection Limit	
Variability of data	Low (<30%)	High (>30%)
Large CV (>1.5)	Mean or upper percentile	Upper percentile
Intermediate CV	Mean or upper percentile	Upper percentile
Small CV (<0.5)	Mean or median	Median

Quantitative decision rules are therefore defined as follows:

- **Decision Rule 2:** If average VOC concentrations in ISB Wells TAN-28 and -30A do not exceed risk-based levels for four consecutive quarterly monitoring rounds, then the remedial action will be determined to have cut off downgradient flux from the hotspot (i.e., met the ISB performance criteria) and the remedial action may be modified. If the decision rule is not supported by the data, then the remedial action will be continued.

- **Decision Rule 3**: If average VOC concentrations in ISB Wells PMW-1 and PMW-2 do not exceed risk-based levels for four consecutive quarterly monitoring rounds, then the remedial action will be determined to have cut off crossgradient flux from the hotspot (i.e., met the ISB performance criterion) and the remedial action may be modified. If the decision rule is not supported by the data, then the remedial action will be continued.

D-1.6 Specify Limits on Decision Errors

The EPA (1992) provides guidance on statistical tests used to establish attainment. Limits on decision errors are stated as α, the acceptable probability of determining that the aquifer is clean when it is not (i.e., a false positive result). Regarding false positives, the guidance states that:

- Reducing the chance of a false positive decision helps to protect human health and the environment

- A low false positive rate does not come without cost; the additional cost of lowering false positive rates comes from taking additional samples and using more precise analysis methods.

Typically, the maximum acceptable probability of a false positive decision is set at 1 to 10%, with input from all planning team members. The preliminary allowable decision error probability is defined as 10%.

D-1.7 Design Data Collection Program

The final step in the DQO process is to design a program to cost-effectively collect data that will meet the DQOs. This program is described in Section 3 of the OU 1-07B ISB GWMP (INEEL 2002d).